

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark  
Office  
(Box PCT)  
Crystal Plaza 2  
Washington, DC 20231  
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year)

28 January 1999 (28.01.99)

International application No.

PCT/RO98/00006

Applicant's or agent's file reference

International filing date (day/month/year)

20 May 1998 (20.05.98)

Priority date (day/month/year)

21 May 1997 (21.05.97)

Applicant

PAVEL, Eugen

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

17 December 1998 (17.12.98)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Céline Faust

Telephone No.: (41-22) 338.83.38

21306

## PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL SEARCHING AUTHORITY

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL SEARCH REPORT  
OR THE DECLARATION

(PCT Rule 44.1)

To:

ROMINVENT S.A.  
Str. Ermil Pangratti nr.35,et.1  
sector 1

RO - 71128 Bucuresti

ROMANIA

Rec'd PCT/PTO 18 NOV 1998

Date of mailing  
(day/month/year)

21/09/1998

Applicant's or agent's file reference

FOR FURTHER ACTION See paragraphs 1 and 4 below

International application No.

PCT/RO 98/00006

International filing date  
(day/month/year)

20/05/1998

Applicant

PAVEL, Eugen

- 1.
- ☒
- The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

**Filing of amendments and statement under Article 19**

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

**When?** The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.**Where?** Directly to the International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland  
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

- 2.
- ☐
- The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

- 3.
- ☐
- With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

- 4.
- Further action(s):**
- The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority

European Patent Office, P.B. 5818 Patentaan 2  
NL-2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl  
Fax: (+31-70) 340-3016

Authorized officer

Clifford Lekahena

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

## INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

### What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

### When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

### Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

### How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

### What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:  
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:  
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:  
"Claims 1 to 6 and 14 unchanged, claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or  
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:  
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled, claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

**"Statement under article 19(1)" (Rule 46.4)**

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

**It must be in the language in which the international application is to be published.**

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

**Consequence if a demand for international preliminary examination has already been filed**

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

**Consequence with regard to translation of the international application for entry into the national phase**

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No.	International filing date ( <i>day/month/year</i> )	(Earliest) Priority Date ( <i>day/month/year</i> )
PCT/RO 98/ 00006	20/05/1998	21/05/1997
Applicant		
PAVEL, Eugen		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (see Box I).

2. ☐ Unity of invention is lacking (see Box II).

3. ☐ The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing

☐ filed with the international application.

☐ furnished by the applicant separately from the international application.

☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.

☐ Transcribed by this Authority

4. With regard to the title, ☒ the text is approved as submitted by the applicant

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:

Figure No. 1 ☐ as suggested by the applicant.

☐ None of the figures

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT 98/00006

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G11B7/00 G11B7/24

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
X	WO 91 07651 A (CORNELL RES FOUNDATION INC) 30 May 1991 see page 5, line 28 - page 6, line 19 see page 16, line 1 - page 17, line 7; claims 7, 18 ---	1-5
E	WO 98 25262 A (GLUSHKO BORIS ALEXEY ; OMD OPTICAL MEMORY DEVICES LTD (IL); LEVICH E) 11 June 1998 see the whole document ---	1, 2, 4
A	US 5 325 324 A (RENTZEPIS PETER M ET AL) 28 June 1994 see the whole document -----	1-5



Further documents are listed in the continuation of box C



Patent family members are listed in annex.

## \* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"3" document member of the same patent family

Date of the actual completion of the international search

14 September 1998

Date of mailing of the international search report

21/09/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5513 Patentlaan 2  
NL - 2250 HV Rijswijk  
Tel: (+31-70) 340-2040, Tx: 31 551 epo nl  
Fax: (+31-70) 340-3016

Authorized officer

Benfield, A

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT 98/00006

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9107651	A	30-05-1991	US 5034613 A	23-07-1991
			EP 0500717 A	02-09-1992
			EP 0807814 A	19-11-1997
			JP 5503149 T	27-05-1993
WO 9825262	A	11-06-1998	NONE	
US 5325324	A	28-06-1994	US 5268862 A	07-12-1993

21306 PCT  
28 Rec'd PCT/PTO 18 NOV 1999  
REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only	
International Application No.	PCT/RO 98/00006
International Filing Date	20 May 1998 (20.05.1998)
STATE OFFICE FOR INVENTIONS AND TRADEMARKS	
Name of receiving Office and "PCT International Application"	
Applicant's or agent's file reference (if desired) (12 characters maximum)	

Box No. I	TITLE OF INVENTION		THREE-DIMENSIONAL OPTICAL MEMORY WITH FLUORESCENT PHOTSENSITIVE MATERIALS	
Box No. II	APPLICANT			
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)		<input checked="" type="checkbox"/> This person is also inventor.		
PAVEL EUGEN Calea Mosilor nr.274, ap. 34, sector 2, Bucuresti, Romania, Cod postal 73252		Telephone No. 401-2118478		
State (i.e. country) of nationality: RO		State (i.e. country) of residence: RO		
This person is applicant for the purposes of:		<input checked="" type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box		
Box No. III	FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)			
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)		This person is:		
PAVEL EUGEN Calea Mosilor nr.274, ap.34, sector 2, Bucuresti, Romania, Cod postal 73252		<input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)		
State (i.e. country) of nationality: RO		State (i.e. country) of residence: RO		
This person is applicant for the purposes of:		<input checked="" type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box		
<input type="checkbox"/> Further applicants and/or (further) inventors are indicated on a continuation sheet.				
Box No. IV	AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE			
The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:		<input checked="" type="checkbox"/> agent <input type="checkbox"/> common representative		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)		Telephone No.		
ROMINVENT S.A. Str. Ermil Pangratti nr.35,et.1, sector 1, Bucuresti, Romania Cod postal 71128		401-2115320		
		Facsimile No. 401-2115300		
		Teleprinter No.		
<input type="checkbox"/> Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.				



**Box No.V DESIGNATION OF STATE**

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

**Regional Patent**

- ☒ **AP** ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA** Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA** OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

**National Patent (if other kind of protection or treatment desired, specify on dotted line):**

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> AL Albania                               | <input checked="" type="checkbox"/> LT Lithuania                                 |
| <input checked="" type="checkbox"/> AM Armenia                               | <input checked="" type="checkbox"/> LU Luxembourg                                |
| <input checked="" type="checkbox"/> AT Austria                               | <input checked="" type="checkbox"/> LV Latvia                                    |
| <input checked="" type="checkbox"/> AU Australia                             | <input checked="" type="checkbox"/> MD Republic of Moldova                       |
| <input checked="" type="checkbox"/> AZ Azerbaijan                            | <input checked="" type="checkbox"/> MG Madagascar                                |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina                | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BB Barbados                              | <input checked="" type="checkbox"/> MN Mongolia                                  |
| <input checked="" type="checkbox"/> BG Bulgaria                              | <input checked="" type="checkbox"/> MW Malawi                                    |
| <input checked="" type="checkbox"/> BR Brazil                                | <input checked="" type="checkbox"/> MX Mexico                                    |
| <input checked="" type="checkbox"/> BY Belarus                               | <input checked="" type="checkbox"/> NO Norway                                    |
| <input checked="" type="checkbox"/> CA Canada                                | <input checked="" type="checkbox"/> NZ New Zealand                               |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein  | <input checked="" type="checkbox"/> PL Poland                                    |
| <input checked="" type="checkbox"/> CN China                                 | <input checked="" type="checkbox"/> PT Portugal                                  |
| <input checked="" type="checkbox"/> CU Cuba                                  | <input checked="" type="checkbox"/> RO Romania                                   |
| <input checked="" type="checkbox"/> CZ Czech Republic                        | <input checked="" type="checkbox"/> RU Russian Federation                        |
| <input checked="" type="checkbox"/> DE Germany                               | <input checked="" type="checkbox"/> SD Sudan                                     |
| <input checked="" type="checkbox"/> DK Denmark                               | <input checked="" type="checkbox"/> SE Sweden                                    |
| <input checked="" type="checkbox"/> EE Estonia                               | <input checked="" type="checkbox"/> SG Singapore                                 |
| <input checked="" type="checkbox"/> ES Spain                                 | <input checked="" type="checkbox"/> SI Slovenia                                  |
| <input checked="" type="checkbox"/> FI Finland                               | <input checked="" type="checkbox"/> SK Slovakia                                  |
| <input checked="" type="checkbox"/> GB United Kingdom                        | <input checked="" type="checkbox"/> SL Sierra Leone                              |
| <input checked="" type="checkbox"/> GE Georgia                               | <input checked="" type="checkbox"/> TJ Tajikistan                                |
| <input checked="" type="checkbox"/> GH Ghana                                 | <input checked="" type="checkbox"/> TM Turkmenistan                              |
| <input checked="" type="checkbox"/> GM Gambia                                | <input checked="" type="checkbox"/> TR Turkey                                    |
| <input checked="" type="checkbox"/> GW Guinea-Bissau                         | <input checked="" type="checkbox"/> TT Trinidad and Tobago                       |
| <input checked="" type="checkbox"/> HU Hungary                               | <input checked="" type="checkbox"/> UA Ukraine                                   |
| <input checked="" type="checkbox"/> ID Indonesia                             | <input checked="" type="checkbox"/> UG Uganda                                    |
| <input checked="" type="checkbox"/> IL Israel                                | <input checked="" type="checkbox"/> US United States of America                  |
| <input checked="" type="checkbox"/> IS Iceland                               | <input checked="" type="checkbox"/> UZ Uzbekistan                                |
| <input checked="" type="checkbox"/> JP Japan                                 | <input checked="" type="checkbox"/> VN Viet Nam                                  |
| <input checked="" type="checkbox"/> KE Kenya                                 | <input checked="" type="checkbox"/> YU Yugoslavia                                |
| <input checked="" type="checkbox"/> KG Kyrgyzstan                            | <input checked="" type="checkbox"/> ZW Zimbabwe                                  |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea |  |
| <input checked="" type="checkbox"/> KR Republic of Korea                     |  |
| <input checked="" type="checkbox"/> KZ Kazakhstan                            |  |
| <input checked="" type="checkbox"/> LC Saint Lucia                           |  |
| <input checked="" type="checkbox"/> LK Sri Lanka                             |  |
| <input checked="" type="checkbox"/> LR Liberia                               |  |
| <input checked="" type="checkbox"/> LS Lesotho                               |  |

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☒ HR CROATIA
- ☒ CY CYPRUS
- ☐

In addition to the designations made above, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except the designation(s) of \_\_\_\_\_

The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

<b>Box No. VI PRIORITY CLAIM</b>		Further priority claims are indicated <input type="checkbox"/> Supplemental Box <input type="checkbox"/>	
The priority of the following earlier application(s) is hereby claimed:			
Country (in which, or for which, the application was filed)	Filing Date (day/month/year)	Application No.	Office of filing (only for regional or international application)
item (1)  RO	21 May 1997 (21.05.97)	97-00928	
item (2)			
item (3)			
Mark the following check-box if the certified copy of the earlier application is to be issued by the Office which for the purposes of the present international application is the receiving Office (a fee may be required): <input type="checkbox"/> The receiving Office is hereby requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s) : _____			
<b>Box No. VII INTERNATIONAL SEARCHING AUTHORITY</b>			
Choice of International Searching Authority (ISA) (If two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used): <u>ISA / EP</u>			
Earlier search Fill in where a search (international, international-type or other) by the International Searching Authority has already been carried out or requested and the Authority is now requested to base the international search, to the extent possible, on the results of that earlier search. Identify such search or request either by reference to the relevant application (or the translation thereof) or by reference to the search request: Country (or regional Office): _____ Date (day/month/year): _____ Number: _____			
<b>Box No. VIII CHECK LIST</b>			
This international application contains the following number of sheets: 1. request : 3 sheets 2. description : 4 sheets 3. claims : 1 sheets 4. abstract : 1 sheets 5. drawings : 2 sheets Total : 11 sheets		This international application is accompanied by the item(s) marked below: 1. <input checked="" type="checkbox"/> separate signed power of attorney 2. <input type="checkbox"/> copy of general power of attorney 3. <input type="checkbox"/> statement explaining lack of signature 4. <input checked="" type="checkbox"/> priority document(s) identified in Box No. VI as item(s): 5. <input checked="" type="checkbox"/> fee calculation sheet 6. <input type="checkbox"/> separate indications concerning deposited microorganisms 7. <input type="checkbox"/> nucleotide and/or amino acid sequence listing (diskette) 8. <input checked="" type="checkbox"/> other (specify): <u>Request for reduction EPO's fees for international search, prelim. examination</u>	
Figure No. _____ of the drawings (if any) should accompany the abstract when it is published.			
<b>Box No. IX SIGNATURE OF APPLICANT OR AGENT</b>			
Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request)			
ROMINVENT SA Lucian ENESCU Manager 			

For receiving Office use only	
1. Date of actual receipt of the purported international application: 3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application: 4. Date of timely receipt of the required corrections under PCT Article 11(2): 5. International Searching Authority specified by the applicant: <u>ISA /</u>	2. Drawings: <input type="checkbox"/> received <input type="checkbox"/> not received. 6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid

For International Bureau use only
Date of receipt of the record copy by the International Bureau:

From the:  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

25 -02-1999

Nr. intrare

3550

PCT

WRITTEN OPINION

(PCT Rule 66)

To:

ROMINVENT S.A.  
Str. Emil Pandrea nr. 35 et 37  
sector 1  
RO - 71128 Bucuresti  
ROUMANIE

Date of mailing  
(day/month/year)

23. 02. 99

Applicant's or agent's file reference

6435

REPLY DUE

within 2 month(s)  
from the above date of mailing

International application No.

PCT/RO98/00006

International filing date (day/month/year)

20/05/1998

Priority date (day/month/year)

21/05/1997

International Patent Classification (IPC) or both national classification and IPC

G11B7/00

Applicant

PAVEL, Eugen

1. This written opinion is the first drawn up by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain document cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

3. The applicant is hereby invited to reply to this opinion.

**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

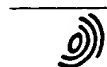
**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also:** For an additional opportunity to submit amendments, see Rule 66.4.  
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.  
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 21/09/1999.

Name and mailing address of the international preliminary examining authority:



European Patent Office  
D-80298 Munich  
Tel. (+49-89) 2399-0 Tx: 523656 epmu d  
Fax: (+49-89) 2399-4465

Authorized officer / Examiner

Poth, H

Formalities officer (incl. extension of time limits)

Gazzoli, M

Telephone No. (+49-89) 2399 2815



**I. Basis of the opinion**

1. This opinion has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed")*:

**Description, pages:**

1-4 as originally filed

**Claims, No.:**

1-5 as originally filed

**Drawings, sheets:**

1/2-2/2 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

3. This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	1:NO; 2,3,4,5:YES
Inventive step (IS)	Claims	2:YES; 3,4,5:NO
Industrial applicability (IA)	Claims	1-5:YES

**2. Citations and explanations**

**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**As to "V Reasoned statement ...":**

1. The following documents (D) are referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1 = US-A-5325324

D2 = WO91/07651

D3 = EP-A-0601714

2. As to claim 1, D1 already describes a data storage and retrieval system (cf. col.15 l.6-33) wherein a fluorescent photosensitive material is used as an optical memory (cf. col.15 l.42-col.16 l.28).
3. Claim 2 essentially stipulates a confocal microscope but which further comprises a rotating optical memory according to claim 1 and a laser for writing, which is not the same as the laser for reading, i.e. the excitation laser.

The object of this is to spatially address the optical memory.

4. D1 already describes with figure 1 the use of focused beams for this purpose, but not within the framework of a confocal microscope.

D2 describes the use of a confocal microscope, but in particular not with a laser for writing or the like in the context of information recording and retrieving.

Hence, the subject-matter of claim 2 is novel and involves an inventive step over the available prior art.

5. As to claim 3 reference is made in D1 to col.56 l.59-61.

Thus, claim 3 does not involve an inventive step, but merely refers to obvious design parameters which are also determined by the respective material of the optical memory.

6. As to claim 4, it is obvious that the excitation beam may have a direction different

from that the fluorescence beam (cf. D3 abstract); to choose a right angle is also obvious.

Consequently, the feature of claim 4 does not involve an inventive step Art.33(3)).

7. As to claim 5, it is noted that its feature is a matter of course for a bigger optical flexibility of the system.

**As to "VII Certain defects ...":**

1. Reference signs in parentheses are not inserted in the claims to increase their intelligibility, R.6.2(b).
2. The Romanian patent applications no.97-00233 and no.97-00761 cited on p.2 l.11 of the present application are not available.

**As to "VIII Certain observations ...":**

1. Claim 1 stipulates that the fluorescent photosensitive material - in fact material"s" are claimed - is/are used "as a support" for the optical memory.

But the fluorescent photosensitive material itself is employed as the information recording medium, not merely as a support for another information recording material.

Therefore, claim 1 is neither supported by the description nor clear with respect to it (Art.6).

2. In claim 2 it is not made clear that the laser for writing is that of the conventional confocal (laser scanning) microscope (Art.6 "clarity").

## PATENT COOPERATION TREATY

## PCT

REC'D 20 MAY 1999

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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 6435	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/RO98/00006	International filing date (day/month/year) 20/05/1998	Priority date (day/month/year) 21/05/1997
International Patent Classification (IPC) or national classification and IPC G11B7/00		
Applicant PAVEL, Eugen		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 4 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of -3- sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  17/12/1998	Date of completion of this report  18. 05. 99
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. (+49-89) 2399-0 Tx: 523656 epmu d Fax: (+49-89) 2399-4465	Authorized officer  Poth, H  Telephone No. (+49-89) 2399 2149 



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/RO98/00006

**I. Basis of the report**

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

**Description, pages:**

1,4	as originally filed			
2,3	as received on	30/04/1999	with letter of	22/04/1999

**Claims, No.:**

1-3	as received on	30/04/1999	with letter of	22/04/1999
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**Drawings, sheets:**

1/2,2/2	as originally filed
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2. The amendments have resulted in the cancellation of:

- |                                     |                  |         |     |
|-------------------------------------|------------------|---------|-----|
| <input type="checkbox"/>            | the description, | pages:  |     |
| <input checked="" type="checkbox"/> | the claims,      | Nos.:   | 4,5 |
| <input type="checkbox"/>            | the drawings,    | sheets: |     |

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/RO98/00006

---

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims 1-3; No: Claims
Inventive step (IS)	Yes: Claims 1-3; No: Claims
Industrial applicability (IA)	Yes: Claims 1-3; No: Claims

**2. Citations and explanations**

**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

---

International application No. PCT/RO98/00006

**As to "V. Reasoned statement ...":**

1. The following documents (D) are referred to in this report:

D1 = US-A-5325324

D2 = WO91/07651

2. As to claims 1 and 2, D1 already describes a data storage and retrieval system (cf. col.15 l.6-33) wherein a fluorescent photosensitive material is used as an optical memory (cf. col.15 l.42-col.16 l.28).

But D1 describes neither as to claim 1 fluorescent photosensitive glass nor as to claim 2 a fluorescent photosensitive vitroc ceramic, but instead in particular an organic material (cf. loc. cit.).

Also D2 does not describe fluorescent photosensitive glass nor fluorescent photosensitive vitroc ceramics, but instead in particular fluorescent indicators (cf. p.15 2nd par.) for biological material (cf. p.13 last par. ff.).

Thus, there is no prior art available, which suggests the subject-matters of claims 1 and 2. Consequently, the subject-matter of claims 1 and 2 involve an inventive step (Art.33(3)).

Hence the subject-matter of claim 3 being dependent on claims 1 and 2 also involves an inventive step.

**As to "VII Certain defects ...":**

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, D1 is not mentioned in the description.
2. Reference signs in the claims are not inserted in parentheses, R.6.2(b).

Summary of the invention

It is the object of the present invention to employ the fluorescence phenomenon to provide a WORM type 3-D optical memory. Since the read cycle uses fluorescence rather than changes in absorption a higher sensibility is obtained.

The invention is based on writing and reading the information in fluorescent photosensitive materials namely fluorescent photosensitive glasses ( E. Pavel, L. Tugulea, Journal of Solid State Chemistry, **134**, 362, (1997); E. Pavel et. al., Optics Letters, **23**, 1304, (1998) ) and fluorescent photosensitive vitrocereamics created by the author of present invention. Writing and reading of said data are carried out with a confocal microscope. The confocal principle was invented by Marvin Minsky, U.S. Patent No. 3,013,467. A point light source is imaged in the object plane. The emitted fluorescent light is directed to a photomultiplier through a detector pinhole. The pinhole is a spatial filter, which permits the analyzing of the light issued only from the focal plane containing this object. This fact ensures obtaining an improved spatial resolution. A computer displays the point as a pixel on a screen. In order to produce a complete image, the light point is moved over the entire object. The arrangement of the detector pinhole, conjugated to the illumination pinhole, ensures that only information from the focal plane reaches the detector. The confocal principle is especially valuable in fluorescence microscopy, since it almost completely eliminates stray light not coming from focal plane.

Thus the system is able to produce fluorescence images with optimum clarity and resolution of fine details. Confocal system LEICA TCS NT achieves an x-/y-resolution of  $0.18\mu$  (FWHM) and a corresponding z-resolution of better than  $0.35\mu$  (FWHM) at  $\lambda = 488\text{ nm}$  and  $\text{N.A.} = 1.32$ . The analyzed volume of the sample is under  $1\mu\text{m}^3$ . An improvement of the fluorescence microscopy has been obtained with two-photon process which is used for the excitation of fluorescent photosensitive material. The two-photon microscopy is a non-linear technique that provides intrinsic three-dimensional resolution with negligible out-of-focus photoexcitation. A similar result is obtained if the excitation beam is perpendicular to the fluorescence beam. The writing process consists of the irradiation of fluorescent photosensitive material with a radiation producing a fluorescence modification in the irradiated areas. The reading is obtained by the excitation of material. Non-irradiated areas have a strong fluorescence.

Invention presents the advantage of a novel device for storage and retrieval data having application in computers.

Disclosure of the invention

5 The invention is further illustrated by four examples which disclose the characteristic features of the invention.

The objects, features and advantages of the invention will become clear from the following description set forth below, in conjunction with the drawings, in which:

FIG. 1 is a block diagram for the writing/reading device.

10 FIG. 2 is a diagrammatic view of the confocal microscope.

Referring to FIG. 1 an optical system for recording and reading data on optical memory 1 is shown. The experimental system includes: a confocal microscope 2, vertical scanning systems 3, 7, a radial scanning system 4, a laser (1) 5, laser (2) 6 and an engine 8 used for rotation of the optical memory 1. The writing process consists in the irradiation of a selected volume of memory 1 with a light beam of the laser (1). The volume selection is carried out with said confocal microscope 2, vertical scanning system 3 and radial scanning system 4. The irradiated volume of fluorescent photosensitive materials suffers a transition ( at electronic level for fluorescent photosensitive glasses and at structural level for fluorescent photosensitive vitrocereamics) which produces the fluorescence modification. Two procedures could be used for reading. One of this procedures produces the excitation with one-photon process. Laser (2) and vertical scanning system 7 are used in the optical system. The second procedure, which is based on said two-photon process, directs the beam of laser (1) to the specimen.

25 The confocal microscope (FIG. 2) used in writing processes has the following elements: two pinholes 9, 10, the lens 11, 12, 13, 15, the beam-splitter 14, the laser 5 and the detector 16.

30 The present invention will be illustrated in greater details by the following examples, but the merits thereof are not intended to be limited by the materials, compositions and procedures described in these examples.

Example 1: A Ce, Eu doped fluorescent photosensitive glass is used as a support for the optical memory namely:

$\text{Na}_2\text{O-P}_2\text{O}_5\text{-}0.005\text{ CeO}_2\text{-}0.005\text{ Eu}_2\text{O}_3$ .

35 Memory writing is carried out with said laser (1) (XeCl laser) at  $\lambda_1 = 308\text{nm}$  and the memory reading is based on said laser (2) Nd:YAG laser with  $\lambda_2 = 532\text{ nm}$ .

5 CLAIMS

- 10 1. A data storage and retrieval system characterized in that the fluorescent photosensitive glasses are used as information recording medium.
2. A data storage and retrieval system characterized in that the fluorescent photosensitive vitroceraamics are used as information recording medium.
- 15 3. A data storage and retrieval system as in claims 1 and 2 characterized in that it comprises:
  - i) a confocal microscope 2;
  - 20 ii) a tunable laser 5, having maximum 100fs light pulses, used in confocal microscope 2 for writing and reading by two-photon process;
  - iii) a vertical scanning system 3 and a radial scanning system 4 used for the movement of writing and excitation beams;
  - 25 iv) a rotating optical memory 1;
  - v) an excitation laser 6, with the beam perpendicular on the fluorescence beam, provided with a vertical scanning system 7 for reading the optical memory by one-photon process.
- 30
- 35



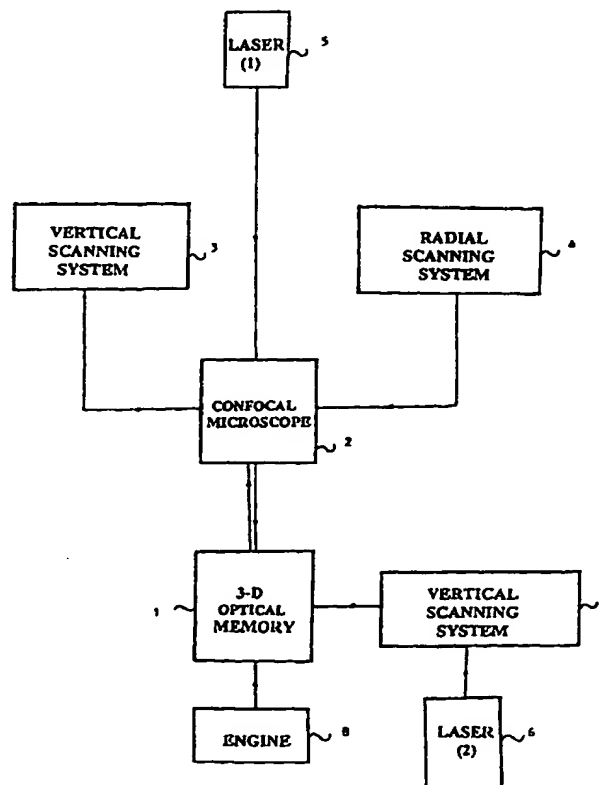
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>G11B 7/00, 7/24</b>	<b>A1</b>	(11) International Publication Number: <b>WO 98/53448</b> (43) International Publication Date: 26 November 1998 (26.11.98)
<p>(21) International Application Number: PCT/RO98/00006</p> <p>(22) International Filing Date: 20 May 1998 (20.05.98)</p> <p>(30) Priority Data: 97-00928 21 May 1997 (21.05.97) RO</p> <p>(71)(72) Applicant and Inventor: PAVEL, Eugen [RO/RO]; Calea Mosilor 274, ap. 34, R-73252 Bucuresti 2 (RO).</p> <p>(74) Agent: ROMINVENT S.A.; Str. Ermil Pangratti 35-1, R-71128 Bucuresti 1 (RO).</p>	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>	

(54) Title: THREE-DIMENSIONAL OPTICAL MEMORY WITH FLUORESCENT PHOTSENSITIVE MATERIAL

## (57) Abstract

The invention relates to a WORM type (write-once-read-many) three-dimensional optical memory made by fluorescent photosensitive materials. The optical memory is based on one-photon and two-photon processes for writing and reading the digital information. Since for reading the fluorescence is used a high reading sensibility is obtained. The invention has the advantage of a novel device for storage and retrieval of the information having application in computers.



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**THREE-DIMENSIONAL OPTICAL MEMORY**  
**WITH FLUORESCENT PHOTSENSITIVE MATERIAL**

5

Technical field

10       The present invention relates to a three-dimensional optical memory with fluorescent photosensitive materials and more particularly to a method and device for storage and retrieval digital data, using fluorescence phenomenon. The device presented in the invention is a WORM type storage system (write-once-read-many).

15

Background of the invention

20       It is known that the growing of computer applications has imposed the necessity for memories with huge storage capacity needed for libraries, government agencies, hospitals, etc. The new memories should have the following characteristics: low-cost, small size and low energy consumption.

25       Present memory technologies, such as semiconductor memories, CD-ROMs, rigid and flexible magnetic disks, and magnetic tape store information on a two-dimensional support. Due to their 2-D nature, these memories are not able to provide parallel access, and their access time grows with increasing capacity.

30       A solution is the use of the third dimension. Three-dimensional optical memories have higher theoretical storage capacity than present 2-D memories.

      For example, the maximum theoretical storage density for an optical disk is  $1/\lambda^2 = 3.5 \times 10^8 \text{ bits/cm}^2$ , while for a 3-D memory  $1/\lambda^3 =$   
35        $6.5 \times 10^{12} \text{ bits/cm}^3$  assuming that the same wavelength of light  $\lambda = 500 \text{ nm}$  is used to access the information. In addition, 3-D optical memory have the potential for parallel access, because an entire plane can be read or written in a single operation. 3-D data storage was experimented on holographic memories made by photorefractive materials (D. Psaltis and F. Mok, Scientific American, November 1995, p.52).

40

Summary of the invention

It is the object of the present invention to employ the fluorescence phenomenon to provide a WORM type 3-D optical memory. Since the read cycle uses fluorescence rather than changes in absorption a higher sensibility is obtained.

The invention is based on writing and reading the information in fluorescent photosensitive materials namely fluorescent photosensitive glass (Romanian Patent Application No. 97- 00005, January 6, 1997) and a fluorescent photosensitive vitroc ceramic (Romanian Patent Applications No. 97-00233, February 4, 1997 and No. 97-00761, April 21, 1997) created by the author of present invention. Writing and reading of said data are carried out with a confocal microscope. The confocal principle was invented by Marvin Minsky. A point light source is imaged in the object plane. The emitted fluorescent light is directed to a photomultiplier through a detector pinhole. The pinhole is a spatial filter, which permits the analysing of the light issued only from the focal plane containing this object. This fact ensures obtaining an improved spatial resolution. A computer displays the point as a pixel on a screen. In order to produce a complete image, the light point is moved over the entire object. The arrangement of the detector pinhole, conjugated to the illumination pinhole, ensures that only information from the focal plane reaches the detector. The confocal principle is especially valuable in fluorescence microscopy, since it almost completely eliminates stray light not coming from focal plane.

Thus the system is able to produce fluorescence images with optimum clarity and resolution of fine details. Confocal system LEICA TCS NT achieves an x-/y-resolution of  $0.18\mu$  (FWHM) and a corresponding z-resolution of better than  $0.35\mu$  (FWHM) at  $\lambda = 488\text{ nm}$  and  $N.A.=1.32$ .

The analyzed volume of the sample is under  $1\mu\text{m}^3$ . An improvement of the fluorescence microscopy has been obtained with two-photon process which is used for the excitation of fluorescent photosensitive material. The two-photon microscopy is a non-linear technique that provides intrinsic three-dimensional resolution with negligible out-of-focus photoexcitation. A similar result is obtained if the excitation beam is perpendicular to the fluorescence beam. The writing process consists of the irradiation of fluorescent photosensitive material with a radiation producing a fluorescence extinction in the irradiated areas. The reading is obtained by the excitation of material. Non-irradiated areas have a strong fluorescence.

Invention presents the advantage of a novel device for storage and retrieval data having application in computers.

Disclosure of the invention

5 The invention is further illustrated by four examples which disclose the characteristic features of the invention.

The objects, features and advantages of the invention will become clear from the following description set forth below, in conjunction with the drawings, in which:

FIG. 1 is a block diagram for the writing/reading device.

10 FIG. 2 is a diagrammatic view of the confocal microscope.

Referring to FIG. 1 an optical system for recording and reading data on optical memory 1 is shown. The experimental system includes: a confocal microscope 2, vertical scanning systems 3, 7, a radial scanning system 4, a laser (1) 5, laser (2) 6 and an engine 8 used for rotation of the optical memory 1. The writing process consists in the irradiation of a selected volume of memory 1 with a light beam of the laser (1). The volume selection is carried out with said confocal microscope 2, vertical scanning system 3 and radial scanning system 4. The irradiated volume of fluorescent photosensitive material suffers a transition (at electronic level for fluorescent photosensitive glass and at structural level for fluorescent photosensitive vitroc ceramic) which produces the fluorescence extinction. Two procedures could be used for reading. One of these procedures produces the excitation with one-photon process. Laser (2) and vertical scanning system 7 are used in the optical system. The second procedure, which is based on said two-photon process, directs the beam of laser (1) to the specimen.

20 The confocal microscope (FIG.2) used in writing processes has the following elements: two pinholes 9, 10, the lens 11, 12, 13, 15, the beam-splitter 14, the laser 5 and the detector 16.

30 The present invention will be illustrated in greater details by the following examples, but the merits thereof are not intended to be limited by the materials, compositions and procedures described in these examples.

35 Example 1 : A Ce, Eu doped fluorescent photosensitive glass is used as a support for the optical memory namely:  $\text{Na}_2\text{O}-\text{P}_2\text{O}_5-0.005 \text{ CeO}_2-0.005 \text{ Eu}_2\text{O}_3$ .

Memory writing is carried out with said laser (1) (XeCl laser) at  $\lambda_1=308 \text{ nm}$  and the memory reading is based on said laser (2) Nd:YAG laser with  $\lambda_2=532 \text{ nm}$ .

Example 2 : A fluorescent photosensitive glass is the support of optical memory as a variant of Example 1:  $2\text{Na}_2\text{O}-(\text{Y}_{0.94}\text{Eu}_{0.05}\text{Pr}_{0.01})_2\text{O}_3-5\text{P}_2\text{O}_5$ . The writing process uses a two-photon absorption of laser light. The recording is carried out by a tunable Ti:sapphire laser (1) at  $\lambda_1 = 720 \text{ nm}$  with 100fs laser pulses. A Nd:YAG laser (2) at  $\lambda_2 = 532 \text{ nm}$  excites the fluorescent material for said reading process.

Example 3 : A Tb doped fluorescent photosensitive vitroceramic is used for the optical memory (wt%), namely:  
 $\sim 30\text{SiO}_2-45\text{PbF}_2-14\text{Al}_2\text{O}_3-10\text{YF}_3-1\text{TbF}_3-0.05\text{Sb}_2\text{O}_3-0.01\text{Ag}$   
 The recording and reading are based on the two-photon processes. A tunable Ti:sapphire laser (1) with 100fs laser pulses writes at  $\lambda_1 = 720 \text{ nm}$  and reads at  $\lambda_2 = 750 \text{ nm}$ .

Example 4 : A similar fluorescent photosensitive vitroceramic as in Example 3 is used for the optical memory (wt%), namely:  
 $\sim 69\text{SiO}_2-15.3\text{Na}_2\text{O}-5\text{ZnO}-7\text{Al}_2\text{O}_3-0.25\text{Tb}_2\text{O}_3-0.25\text{CeO}_2-0.2\text{Sb}_2\text{O}_3-0.01\text{Ag}-2.3\text{F}-0.7\text{Br}$ . The writing is carried out with a tunable Ti: sapphire laser (1) with 100fs laser pulses using  $\lambda_1 = 720 \text{ nm}$  while for reading is used  $\lambda_2 = 980 \text{ nm}$ .

## 5 CLAIMS

- 10 1. A data storage and retrieval system characterized in that the fluorescent photosensitive materials (fluorescent photosensitive glass and fluorescent photosensitive vitrocera-  
mic) are used as a support for optical memory.
- 15 2. A data storage and retrieval system as in claim 1 characterized in that it comprises:
- i) a laser (1) 5 for writing;
  - ii) a confocal microscope 2;
  - 20 iii) a vertical scanning system 3 and a radial scanning system 4 used for the movement of writing and excitation beams;
  - iv) a rotating optical memory 1;
  - v) an excitation laser (2) 6 provided with a vertical scanning system 7 for reading the optical memory by one-photon process.
- 25 3. A data storage and retrieval system according to claims 1 and 2 characterized in that the laser (1) is a pulse laser with 100fs laser pulses and uses for writing and reading the two-photon process.
- 30 4. A data storage and retrieval system according to claims 1 and 2 characterized in that the excitation beam is perpendicular on fluorescence beam in the case of one-photon process.
- 35 5. A data storage and retrieval system according to claims 1, 2, 3 and 4 characterized in that the two lasers are tunable in order to operate at a variable frequency.
- 40

1/2

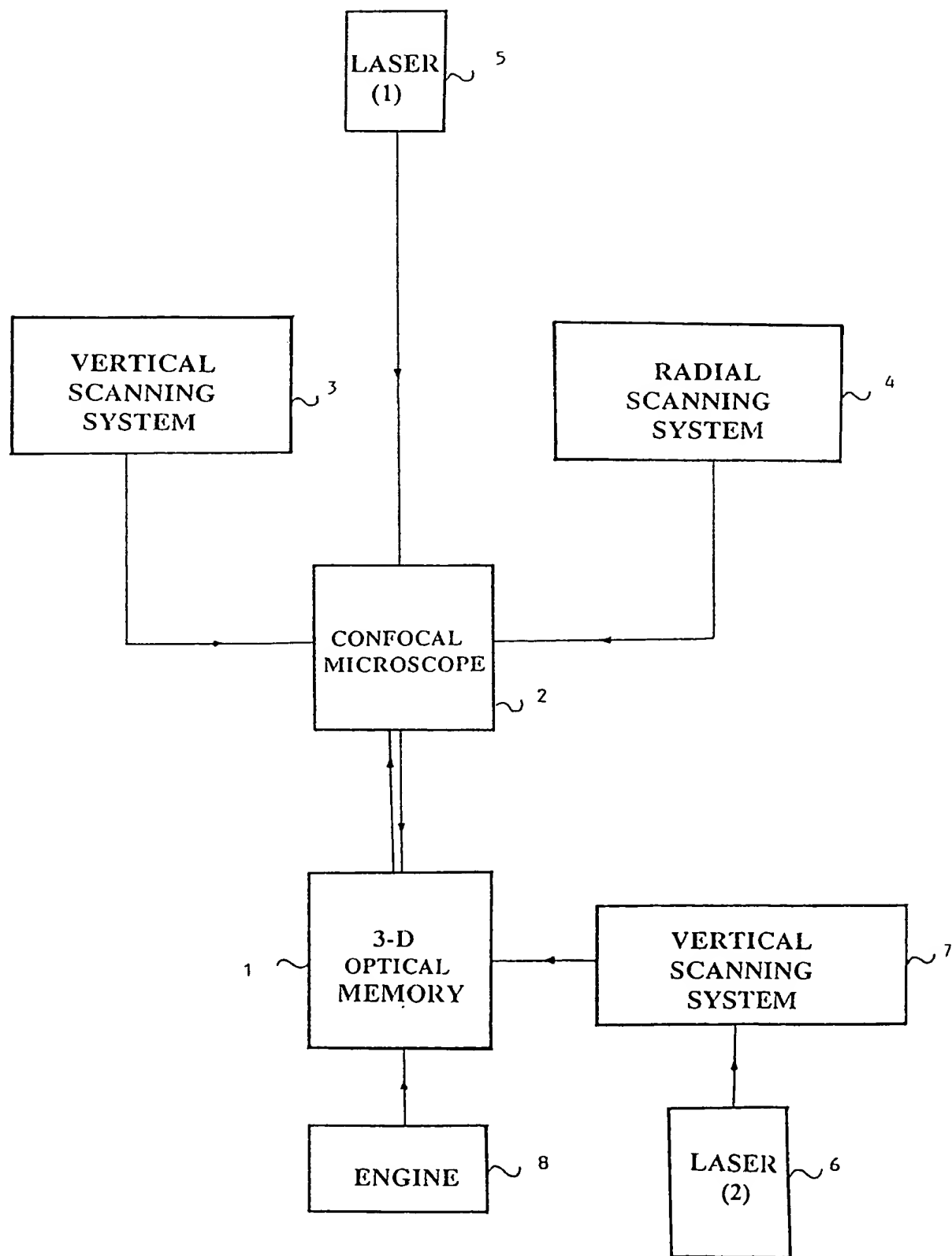


FIG. 1.

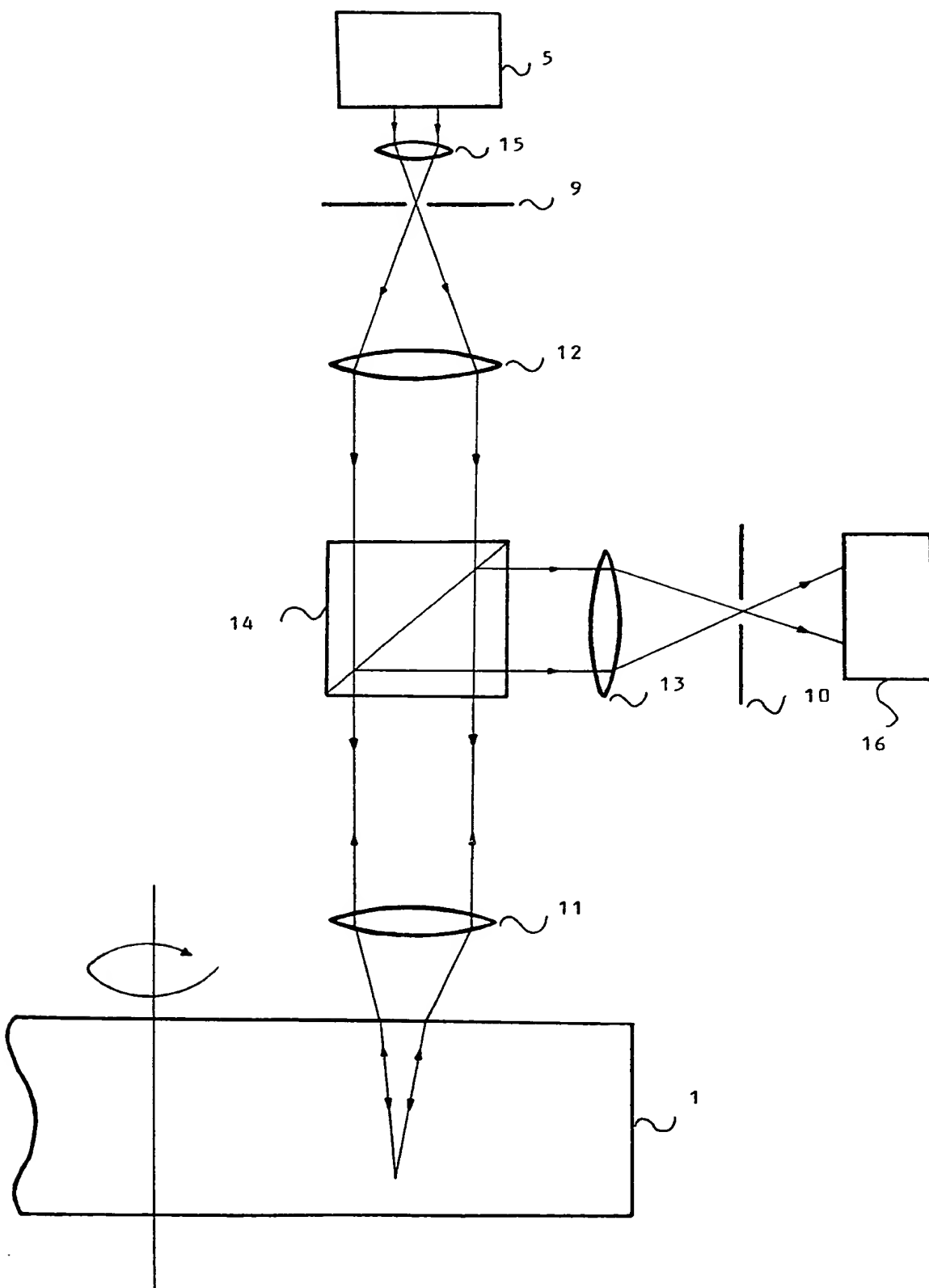


FIG. 2

# INTERNATIONAL SEARCH REPORT

Inter. Application No

PCT/RO 98/00006

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 G11B7/00 G11B7/24

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 91 07651 A (CORNELL RES FOUNDATION INC) 30 May 1991 see page 5, line 28 - page 6, line 19 see page 16, line 1 - page 17, line 7; claims 7, 18	1-5
E	WO 98 25262 A (GLUSHKO BORIS ALEXY ; OMD OPTICAL MEMORY DEVICES LTD (IL); LEVICH E) 11 June 1998 see the whole document	1, 2, 4
A	US 5 325 324 A (RENTZEPIS PETER M ET AL) 28 June 1994 see the whole document	1-5

☐ Further documents are listed in the continuation of box C.

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\* Special categories of cited documents :

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- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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Date of the actual completion of the international search

14 September 1998

Date of mailing of the international search report

21/09/1998

Name and mailing address of the ISA

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Benfield, A



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/RO 98/00006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9107651 A	30-05-1991	US 5034613 A EP 0500717 A EP 0807814 A JP 5503149 T	23-07-1991 02-09-1992 19-11-1997 27-05-1993
WO 9825262 A	11-06-1998	NONE	
US 5325324 A	28-06-1994	US 5268862 A	07-12-1993

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/R0 98/ 00006	International filing date (day/month/year) 20/05/1998	(Earliest) Priority Date (day/month/year) 21/05/1997
Applicant  PAVEL, Eugen		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (see Box I).

2. ☐ Unity of invention is lacking (see Box II).

3. ☐ The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing

☐ filed with the international application.

☐ furnished by the applicant separately from the international application.

☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.

☐ Transcribed by this Authority

4. With regard to the title, ☒ the text is approved as submitted by the applicant

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:

Figure No. 1 ☐ as suggested by the applicant.

☐ None of the figures.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/RO 98/00006

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A	US 5 325 324 A (RENTZEPIS PETER M ET AL) 28 June 1994 see the whole document -----	1-5

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Benfield, A

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International Application No

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WO 9825262 A	11-06-1998	NONE	
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